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THE

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AND OF

THE INSTITUTIONS IN UNION.

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Announcements by the Council.

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Cantor Lectures.

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

Mr. Hawkins will resume his Course, on Monday Evenings, as follows:—

Jan. 16th.—Lecture III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

Jan. 23rd.—Lecture IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Jan. 18.—"On the Best Mode of Applying Power to Propel Trains, on the Metropolitan and other Railways having Frequent Stations, and in Terminal Stations." By Peter W. Barlow, Esq., F.R.S.

Jan. 25.—"On the Best Mode of Protecting London from the Ravages of Fire." By Chas. F. T. Young, Esq., C.E.

Feb. 1.—"On London Sewage, from the Agricultural Point of View." By J. Chalmers Morton, Esq.

Technical Training of Artizans.

The following letter has been addressed to the Chairman of the Council by Mr. Twining, one of the Vice-Presidents of the Society:—

Sir,—As it is partly owing to the encouragement which yourself, as well as Mr. Chester and others of my colleagues, have given me, that I have been induced to pursue further the subject of the Technical Training of Artizans, I feel that I need scarcely apologise for submitting to you a brief report of the progress which I have made.

The desirableness of providing for our artisans facilities for the perfecting and testing of their technical knowledge and efficiency equal to those enjoyed by their continental brethren, is impressively expounded in Mr. Davenport's very able paper, and he has clearly shown that it is the province of the Society of Arts to take the lead in a national movement for that purpose. I feel myself called upon, whilst expressing my concurrence with these views, to show that my own objects would perfectly harmonize with them.

My chief object is for the present to induce and enable the Society of Arts to make the experiment of holding, in addition to its Annual General Examinations, Technical Examinations for testing the abilities of certain classes of workmen, hereinafter described, and of granting certificates of competency which may be useful to them, and offer a desirable guarantee to the public.

The following are among the preparatory steps which I have taken:—

I have obtained, through the kindness of my continental friends, a considerable amount of interesting information, in addition to that already published in England, concerning the Industrial Institutions and Trades Regulations of various parts of Europe. The whole is now in the hands of Mr. Iselin, who had undertaken to prepare a digest or synopsis, bringing into relief everything likely to be of useful application in this country. I regret that its completion is inevitably retarded by Mr. Iselin's engagements in connexion with the Dublin Exhibition.

It was desirable to ascertain what books and other materials for technical instruction exist and come sufficiently within the scope of the proposed Examinations to be of service as text-books. I have got together nearly all the small handbooks of the kind published of late years in

England, and, finding that scarcely any would answer our purpose, I have procured from Paris a selection of the best French publications of this description. The whole of the collection, amounting to seventy-eight volumes, is deposited at the Society of Arts. I intend getting one or two suggestive specimens of text-books, specially suited to our requirements, prepared by competent authors. Some of them, of which a sketch is already prepared, will embrace, for the use of several trades in common, those elements of scientific knowledge which several require, whilst others will offer for each trade in particular that technical information which specially appertains to it.

It would be now premature to publish a detailed account of the proposed Examinations, but it may be well to state at once that I do not think of interfering with art-workmen, whose attainments can be sufficiently tested by exhibitions, whilst the subject of their training is already in good hands; nor do I intend including the higher class of foremen of manufactures, or the lower class of factory hands. The first experiment would, indeed, be restricted to a few select handicrafts and technical trades, involving knowledge susceptible of being satisfactorily tested, and the acquisition of which wants encouragement.

The success of our manufacturing industry proves that English workmen possess qualities of mind, and a temperament of body, which peculiarly suit them for discharging regularly and efficiently, under the guidance of intelligent foremen and enterprising manufacturers, a definite task assigned to them in the routine of factory work, and mostly involving neither science, art, nor origination. The case is different with the tradesman or mechanic who is expected to turn a ready hand to the various duties of a complex handicraft, and who must rely on his own knowledge and ingenuity for helping himself or for serving his employer. Here we too frequently find shortcomings as to technical knowledge and practical intelligence, which occasion waste of expenditure, annoyance, and discomfort to the public, whilst they entail unnecessary trouble, and oftentimes injury to health or limb on the artizan himself. This is by no means to be wondered at, considering on the one hand the lax system of technical training which has hitherto generally prevailed, and, on the other hand, the absence, among a large portion of the work payers, of that scientific knowledge which would make them alive to, and impatient of, the ignorance of those whom they employ.

Now, in several parts of the Continent, a system of examinations prevails calculated to secure the public, in a great measure, against inefficiency on the part of the artizans they may have occasion to employ, by maintaining among them definite standards of technical knowledge and manual ability, according to their position as subordinate workmen or masters in trade.

The following is an extract from a letter received from a friend in Germany, well acquainted with the manufacturing and commercial industry of that country:—"I enclose an abstract of the law in Prussia concerning the exercise of trades and handicrafts. . . . . It is in full practice, and nobody thinks of abolishing it; indeed, it works admirably, and the public are certain to be served by men who understand their trade. In your country any person can commence a trade, whilst in ours he must first show that he has the necessary capacity and knowledge for its successful exercise."

What I propose to adopt is the principle of examinations as a test for and an incentive to efficiency, but certainly not the regulations which in Germany render them compulsory. The Society of Arts Technical Examinations would, of course, be as voluntary as its Examinations in General Knowledge. They would offer benefits without trammels, and care would be taken that they should not unduly interfere with the usages, or even with the prejudices of industrial trades, whose credit and advantage they would, in fact, serve no less than the interests of the work-employing public. I feel confident that if this plan should be adopted, the young artizan would see more clearly defined what he *must* know and what he *ought* to know. Facilities for acquiring knowledge would be placed before him, together with a prospect of distinction and well-paid employment if he made good use of them; and technical efficiency, being thus rendered a good marketable commodity, would be sure to prosper in this land of pounds, shillings, and pence.

The class of candidates whom we should have chiefly to deal with would differ widely from those who come up to the Society of Arts General Examinations, as to aptitude for receiving instruction, as to the nature of the instruction which they would require, and, consequently, as to the suitable mode of testing it. I believe that in most cases it would be best to imitate the German system and that of the Pharmaceutical Society of London, and to hold for each trade a minor and major examination. The minor would correspond to the denomination of journeymen, companions, or mates, and the major to the denomination of accomplished workmen or masters in trade. For each of these examinations there should be three classes of certificates, marking—Competency, Ability, and Excellency. If our operations obtained general recognition, journeymen or mates would find hereafter that to make their way in the world they ought to be able to show, at least, a third-class minor certificate, whilst a first-class major certificate would secure to any man a high standing in his trade.

A mere glance at the educational condition of our second-class workmen will show that the minor examinations could not be carried on by written papers, and would have to be conducted orally, even if this were not rendered necessary by the nature of the questions to be put to the candidates, frequently involving actual practice at the recognition of articles and adulterations, the display of manual ability, &c. In these matters again we could not do better than follow the Pharmaceutical Society, as also in holding the major examinations partly orally and partly by means of printed forms and written answers.

Lectures and classes would be very useful for the preparation of candidates; but this and other similar points, to which it is unnecessary to advert at present, can best be settled when the measures shall have been determined which the Council may be inclined to adopt in the direction mentioned in Mr. Davenport's valuable memorandum. As regards the financial point of view, I may state my willingness to defray, not only the preparation of the text books required, but also the examination fees for the first experiment.—I remain, &c., T. Twining.

Proceedings of Institutions.

Bacup Mechanics' Institution.—On the 3rd January, the 26th Annual Soirée of this Institution was held, when the spacious hall was crowded in every part. After tea, to which about 700 sat down, the Venerable President, Lawrence Heyworth, Esq., opened the proceedings, and took the opportunity to present several books to the society. The secretary's report stated that the finances were in a healthy state, there being a balance in hand of £12 10s. The number of members on the books had averaged 245 per quarter. Ninety volumes had been added to the library, and an increase had taken place in the issue of volumes to the members, the total having been 7,038, or an average of 41 to each member. The increase in attendance at the evening classes has been considerable. In efficiency, as tested by the local Society of Arts, Science and Art, East Lancashire, and Lancashire and Cheshire Union Examinations, the school has made decided progress. A great many prizes and certificates have been obtained by the scholars. It is a source of regret that in some of these examinations the candidates are almost entirely from the younger members of the classes, while elder ones make no attempt to compete in them.

The establishment of the Science Classes, in which Chemistry and Physiology are taught, has been attended with the best results, and has given a *status* to the Institution which it otherwise could not have obtained. The evening was enlivened by some excellent songs and music and a Christmas entertainment; and speeches were made by the following gentlemen:—Alexander Mackie, Esq., of Warrington; the Rev. J. A. Shrewsbury, of Manchester; the Revs. M. Johnson and T. Lawson, of Bacup; John Dawson, Esq.; Capt. Aitken, the Chairman, and several other gentlemen in the neighbourhood.

DUBLIN INTERNATIONAL EXHIBITION.

Besides the official patronage extended to the undertaking, Her Majesty has further evinced her interest in the Dublin International Exhibition, by consenting to lend from her collection pictures by the following painters:—Wilkie, Mulready, Stanfield, Roberts, and Thomas. The Fine Arts Committee, presided over by Viscount Powerscourt, has been very successful in obtaining the loan of choice and valuable works; and Sir J. J. Coghill, Bart., one of the committee, is coming over to England to select other pictures from the collections of noblemen and gentlemen who have expressed their disposition to lend works.

The British Colonies, although labouring under disadvantages from the short notice given them and the difficulty of obtaining legislative grants so soon after the last London Exhibition, will be very fairly represented by small but interesting collections of produce and manufactures. The Australasian Colonies will have collections of their wools, wines, fibres, silk, woods, oils, cotton, grain, arrowroot, minerals, and objects of natural history, and even some illustrations of fine arts in photographs and pictures. India will show a magnificent collection of raw products and rich manufactures, arranged by Dr. Forbes Watson, of the India Museum. Ceylon sends carved wood tables, a fine collection of fibres and ropes, gums, oils, grains, and pharmaceutical products. Malta will show the carved stonework, silver filigree, and the fine lace for which she is so famous, with probably mosaic work and other articles. The North American Colonies are making some preparations to be represented. Several of the West India islands send furniture, cotton, and other fibres, objects of natural history, shell work, pimento, coffee wood, and other walking sticks, which have recently risen into a large and profitable trade, besides samples of those staple products which are the mainstay of their industry. Lagos, Sierra Leone, and other West African Colonies, will make a fine display of native mats and basket work, country cloths, native curiosities, carved calabashes, and articles of produce. Most of the African merchants and companies have promised their aid in contributions. Other Colonies will contribute produce and miscellaneous objects of various kinds.

ENGRAVING AND OTHER REPRODUCTIVE ART PROCESSES.

By S. T. Davenport, Esq.

To the antiquity of the art of engraving it is not my intention to do more than allude; it is abundantly evident that it was known to the Egyptians, and used long prior to the Christian period. The art was probably one which grew out of the necessity of attaching some distinguishing mark to individual works, or from the custom of recording the history of the early ages by cutting them in stone, many examples of which have been preserved to us. Soft bodies were also impressed with the maker's marks, as in the case of ancient bricks and other plastic bodies; and thus, what was in the first instance an isolated mark, led to and became a reproductive art. From a sculptured or monumental art a refined art grew up, of which, and the perfection to which it attained at an extremely early date, the engraved gems and seals preserved in our museums give ample evidence. Engraving on metal was early employed as a means of ornamenting articles of dress; and the coins preserved to us show how the skill of the die-sinker and engraver in metal became the basis of another reproductive art. Engraved metal plates have been found in the coffins of mummies, and are preserved in the British Museum. In India engraving on plates of copper appears to have been practised long prior to the Christian period. It was there customary to ratify grants of land by deeds of transfer actually engraved on copper, and a copy of one such relic, with an English translation, is given by Mr. Wilkins, in the 1st vol. of the "Asiatic Researches," page 123,—an early proof of the commercial use of engraving. To trace the history of engraving on stone and metal to the period when the art of printing was discovered, would only be to repeat an oft-told tale, and tend to prove that the one object which all appear to have had in view has been to facilitate the means of reproducing, at a cheaper rate and by a more ready means, copies of the works of the artist and engraver. It has appeared to me that the present is not an inopportune time for reviewing some of the changes which have been either introduced, or proposed for introduction, during the last half-century, and which have placed us in our present position with reference to the art of engraving, or its substitutes, for illustrative commercial art purposes. With a view, however, of making what I have to say more clear, it is necessary that I should state what were the peculiarities of the art processes in common use prior to the beginning of the present century. The earliest specimens of prints from engravings were those obtained from wood blocks on which the design was cut in relief, but the art of engraving on wood, though greatly improved, continued in an extremely imperfect state till within the last half-century. The perfection to which the art had attained in the year 1803, may be ascertained by a reference to Vol. xxi. of the Transactions of the Society of Arts, in which is printed a specimen showing the great progress which the art had made at that date; and at page 13 of the Preface we find the following:—"It has been frequently asserted that the art of engraving on wood is not, at the present day, equal to what has been done by some of the ancient masters, but when the emblematical performance of young Austin in this line, prefixed to the present list of premiums, is considered as the work of so young an artist, it may probably appear that it cannot be excelled by many artists in Europe of a similar age, and the reward assigned is likely to excite his emulation to progressive improvements in that art." The reward given was the silver medal and ten guineas—and the block was for many years used by the Society as a specimen of the art, and was printed at the head of the Secretary's letter announcing the election of new members. The art was, however, carried to considerable perfection by Bewick, who applied it in the illustration of his "Natural History of Beasts and Birds," and the commercial condition of wood engraving may be seen by a reference to that work. The earliest specimen of a print from a wood block is one known as the St. Christopher, and is dated 1423.

The earliest use of engraved metal plates in England probably dates from the time of the Conquest, but Mr. Strutt states that he has not seen any with a date prior to 1284. They were then used as monumental brasses or tablets, and were executed with the graver, and are assumed to have been produced by ecclesiastics. The same principle which was applicable to the production of monumental brasses, viz., the removal of a portion of the surface of a metal plate by cutting it away, according to any desired design, by means of the graver, was applied by goldsmiths in the production of Niello work. The earliest known print from a metal plate is one which can be seen at the Imperial Library, Paris; it is attributed to Tomaso Feneguerra, the Florentine goldsmith, and bears the date 1452, and the earliest known book illustrated in this way bears date 1478, and was printed at Rome. The next step in the improvement of the art of engraving is said to have taken place at the beginning of the sixteenth century, and is attributed to Albert Dürer, to whom is ascribed the invention of the art of etching, or drawing with a metal point or tracer, upon a plate, the surface of which was covered with wax or varnish; and the etching or drawing being afterwards permanently engraved in the metal plate by the action of acid. The process of etching afforded an opportunity of exercising any required amount of freedom of hand in the production of foliage or landscape, and soon led to a combination of the two processes, and was the means by which engraved copper-plates were usually produced at the beginning of the present century. This process is known as line engraving; it is a slow, tedious, and costly means of copying works of art; its peculiarity is, that it affords facility for giving a large amount of drawing and minuteness of detail, at the same time that it admits of the greatest possible gradation of light and shadow, and the most perfect artistic effect. The process of etching was largely used by Rembrandt. The most perfect works executed in the early days of this art are, however, to be found in the portraits and historical subjects, for the reproduction of which it was especially suited, though in later times it was largely and most effectively employed in the copying of architectural, monumental, and landscape art. Copperplate engravings were printed in England, in "Vesalius's Anatomy," as early as 1545, but the English school of engraving cannot be said to have existed till about the middle of the eighteenth century, at which period efforts were made to advance the interests of artists in this country. It was during the reign of George the Third that the Royal Academy was established, and as art advanced, so with its advancement grew up the use by our artists of the etching point and the graver in a more refined and skilful manner. But the mere reproduction of copies of pictures from engraved plates printed in black inks did not long continue to satisfy the public, and efforts were soon made to print in colours from these engraved plates, but no thoroughly satisfactory results were obtained from line engravings in this direction, and recourse was had to the next process, to which I shall call attention.

Line engravings were executed (as before stated) by cutting away the surface of the copper-plate by means of the graver, which, for this purpose, was made concave in its length, and varied from a square to a thin V-shape in its width, thus enabling either a narrow or a broad line to be cut, while by a slight variation of pressure, or by depressing the hand of the operator, the point of the graver was gradually driven along the metal or freed from the plate altogether.

Chalk or Stippled Engraving, the next process to which I have to refer, was, on the contrary, executed by means of a graver of an arched or convex form, which when applied to the copper-plate could not relieve itself from the surface of the metal, the whole tendency, wherever pressure was applied, being to thrust itself deeper and deeper into the metal, leaving a punctured dot, varying in breadth or delicacy according as the graver itself was more or less square or V-shaped on its face. This mode of puncturing the face of a metal plate was known as "chalk engraving," from the clusters of dots being so arranged as to imitate the granulated effect of lines drawn upon cartridge paper with Italian chalk. This process was especially suited to portraiture, or groups of statuary, owing to the softness of its gradations from light to shadow, and the production of an equal grain over the entire surface of a piece of metal. It was ill-adapted, however, to the production of landscape effects.

The Mezzo-tinto is a method of engraving, the discovery of which is attributed to Prince Rupert, and it may not be uninteresting to quote the following letter by Dr. Diamond, which was communicated by him to the Society of Antiquaries in 1838, and to which is appended a catalogue of the earliest known works in mezzotinto. The catalogue will be found in vol. xxvii., pages 405 to 409, of the Archæologia.

To Sir Henry Ellis, K.H., F.R.S., Secretary of the Society of Antiquaries.

"Dear Sir,—In the last session I had the honour of laying before the Society of Antiquaries, several remarkable specimens of early mezzotinto engraving, which prove beyond doubt that the generally received opinion as to Prince Rupert being the inventor of that style of engraving is erroneous. From the examples then exhibited, it appears that the person to whom the merit of the invention is due, is Louis von Siegen (or *L. à* Siegen), a lieutenant-colonel in the service of the Landgrave of Hesse Cassel. The works of this amateur artist are of considerable rarity; and it is not improbable that they were merely distributed among his friends and patrons. Baron Heineken, in his 'Idée Générale d'une Collection complette d'Estampes,' printed at Leipsic, in 1771, says decidedly that Siegen was the inventor of mezzotinto engraving, and observes that the first specimen which appeared was the portrait of the Princess Amelia, Landgravine of Hesse; he adds, that Prince Rupert learnt the art from Siegen, and that eventually it became public. In the new edition of Granger's Biographical History of England we find some observations on the invention of this style of engraving:—'It should not be forgotten that Sir Christopher Wren is said to have been the inventor of mezzotinto; it is certain there is a Blackamoor's head by him in a different manner to that of Prince Rupert; also, Vertue, in a manuscript in my possession, mentions a large head *something like mezzotint*, of the Princess Amelia of Hesse, thus inscribed: 'ad vivum a se primùm depictam, novoque jam sculpturæ modo expressam, dicat consecratque L. à S. anno 1643.' Mr. Wanley says there is one of this lady in Lord Harley's collection of heads, also one of the Comes of Hesse by the same hand, who was the person who taught Prince Rupert.' Mr. Lodge, in his life of that prince contained in his Portraits of Illustrious Persons, after mentioning the prince's contributions to science, and various discoveries, says, 'But the discovery which we find most frequently associated with his name, is of the art of engraving in mezzotinto, the first hint of which is said to have occurred to him from observing the effect accidentally produced by a soldier scraping some rust off the barrel of his musquet; his right, however, to the strict reputation of inventor has been somewhat questioned, *but with little probability.*'

"It will be seen by this that Heineken's authority is doubted; but Mr. Strutt, in his 'Biographical Dictionary of Engravers,' although more cautious, is nevertheless in doubt on the subject; for he says, after noticing the story of Prince Rupert's observing the soldier scrape the rust from his musquet:—'If the account, as given by Baron Heineken, be allowed as authentic, and it bears every appearance of being true, especially *if such a portrait really exists*, then the probability of the first story is entirely destroyed. I must leave the reader, however, to decide, having given him all the information I could obtain on the subject.'

"Now, from the extracts given, it is evident that neither Strutt, Bryan, Granger, nor Noble have ever seen the engravings in question; and it is a remarkable fact, that not one of them is to be found in the fine collection of the British Museum. The example I have now the pleasure of exhibiting, is a portrait of the eldest daughter of Charles the First, inscribed: 'Augusta Maria Caroli: M: B: Reg: Filia. Princ: Aur. Sponsa.' and is of great rarity; one other only being known in England, namely, that in the collection of Mrs. Sutherland; which is, however, I am informed, very much injured.

"The present portrait, as a work of art, is curious from its combining two distinct styles of engraving; the figure being entirely mezzotinto, and the back-ground in line and 'cross-hatched.' The likeness is highly interesting from the strong resemblance which it bears to the Stuart family, especially to Charles the Second, and his brother, Frederick Duke of Glocester. Near the base of the picture in the right-hand corner are the words, 'Honthorst pinxit, L. à Siegen inv. [enit] et fecit;' and it is worthy of observation, that the word *Inventor* is generally found on the works of Siegen. On the Holy Family engraved by him after Caracci, and dedicated to Cardinal Mazarin, is the following remarkable inscription:—'Eminentissimo Domino D. Julio Mazarini S. R. E. Cardinali, &c. Novi hujus Sculpturæ modi *primus inventor* Ludovicus a Siegen humilissime offert, dicat et consecrat, Ao. 1657.'

"Huber, the compiler of Winckler's Catalogue, tells us that Theodore Caspar de Fürstenbergh, a Capitulary Canon of Mayence, was an engraver in mezzotinto; that his works are contemporary with those of Siegen, and expresses a doubt as to which was the disciple of the other; adding, if Fürstenbergh learnt the art of Siegen, he excelled his master. But there is no evidence whatever to warrant this doubt; on the contrary, the portrait of the Queen of Bohemia, which I exhibited in February last, bears the date of 1643, while the earliest known specimen of Fürstenbergh is dated 1656. It is only necessary to add that Rupert's earliest effort in mezzotinto (though etchings of this Prince are earlier, and one is known inscribed Rup. Pr. 1637) is of the year 1658. In conclusion, I subjoin a catalogue of the known works in mezzotinto of Siegen, Fürstenbergh, and Rupert, as the same has not to my knowledge ever been printed.

"I have the honour to remain, Sir Henry,
"Your obedient and humble servant,
"Hugh W. Diamond."

Louis von Seigen (*or L. a Seignen*), *born* 1820.

No. 1. The Virgin holding the infant Jesus. In front, on the right of her, is St. John; and behind, St. Joseph holding a book in one hand and a pair of spectacles in the other, after Caracci; with the inscription, "Eminentissimo Principi Domino D. Julio Mazarini S. R. E. Cardinali, etc. Novi hujus Sculpturæ modi *primus* inventor Ludovicus a Siegen humilissime offert, dicat et consecrat." Ao. 1667. (Height 13¼ inches, width 10⅞, without the inscription.)

2. Portrait of the Landgravine of Hesse with this inscription, "Amelia Elisabetha, D. G. Hassiæ Landgravia, etc. Comitissa Hanoviæ Muntzenb. Illustrissimo ac Celssimo Pr. & D'no, D'no Wilhelmo VI. D. G. Hassiæ Landgr. etc. hanc Serenissimæ Matris et Incomparabilis Heroinæ effigiem ad vivum à se primùm depictam novoq' jam Sculpturæ modo expressam, dedicat consecratq' L. à S. A'o D'nj. cIo. Io.CXLIII. (Height 17 inches, width 12⅛.)

⁂ This is the portrait spoken of by the Baron Heineken.

I am also enabled, through the kindness of Dr. Diamond, to append the copy of a letter addressed by L. de Siegen to his Highness the Landgrave of Hesse-Cassel, and which I believe has never before been printed in this country, and appears to substantiate his claim to be recognised as the inventor of the mezzotinto art.

"To His Highness the Landgrave of Hesse Cassel.

"Serene and high-born Prince—Most gracious Lord,—In the same manner as my humble devotion, more than a consideration of reward, has brought me to your grace's service; though these services, however agreed by your grace, have been rather derogated by some persons, yet I have not relented in devoting to your grace my diligence, my labour, and my time, in proof of which I most humbly do present the present print to your princely grace.

"This is the copper print, most gracious Prince and Lord, which some time ago I mentioned to you to have executed, to your grace's mother's laudable commemoration, with a view to bring the said portrait into the possession of several persons of rank, acquainted with the illustrious deeds of this far-famed Princess.

"But having invented quite a new and hitherto an unknown proceeding, I have been enabled to print from the copper, not thousands (as from common plates), but only a few, owing to the subtlety of the workmanship, for which reason I have only a small number of copies to present.

"Of course I first of all make application to your princely grace, especially in dedicating the same to you, according to the inscription at the bottom, and for the following reasons:—

"The first, in remembrance of your mother, because the said object cannot be but most agreeable to your grace, as being the nearest, nay, the only son of the reigning Prince,

"For the second, because I dare not omit dedicating a work of art so rare and never heard of before, to such an extraordinary amateur of the fine arts as your grace is.

"No engraver or no artist will be able to imagine how this work could be done, because, as your grace is aware of, hitherto only three different species of workmanship are seen, namely,—

"First, line engraving, or cutting;

"Secondly, etching;

"Thirdly, a very uncommon manner, called the dotting manner, with points altogether, but different and very troublesome, and, therefore, not much in use.

"The present manner, however, is none of those, though also consisting of little dots without a single line, and though some parts have the appearance of lines, the whole is altogether stippled.

"I ought not to omit to state this for the guidance of such an experienced connoiseur as your grace is.

"Recommending your grace to the Divine Providence and welfare, I also recommend myself, remaining your grace's most true and humble servant,

"L. de Siegen.

"Amsterdam, 29th August, 1642."

The mezzotinto is a process altogether distinct from those previously mentioned, and was effected in the first place by puncturing or breaking up a uniform burr over the entire face of a copper plate, from which, if a print were taken, an impression in density of colour would be obtained equal to that required in the darkest parts of the picture to be copied. Upon this ground the subject to be engraved was traced, and by scraping and burnishing away the burr or dotted surface impressed in the face of the plate, either in part or wholly, the necessary gradations of light and shadow were obtained. This process, although affording facilities for covering large surfaces, did not admit of being applied on a small scale, so as to give detail of drawing or delicacy of outline, and was in the main inapplicable to the production of foliage, and when first practised was grey in colour and flat in effect. At a later period, with the view of facilitating the operations of the engraver, an instrument called a roulet was invented, and was used for the purpose of impressing a series of dots into the metal.

The first person who applied the mezzotinto process on steel was Mr. T. Lupton, who, in 1822, submitted a specimen of his work to the Society of Arts, and stated that in order to obtain the necessary ground on the steel plate he had been obliged to lay his ways in 80 or 90 directions, whereas in preparing or breaking up the surface of a copper plate from 24 to 40 ways were all that were required. The use of steel necessitated a much stronger hand and an increased number of ways in laying the ground, but the advantage of steel over copper was that from eight to ten times the number of prints could be taken.

Aqua-tinta, a process of engraving which was extensively used at the beginning of the present century, but which is now rarely employed, was executed by a process of the following description:—The surface of the plate of metal to be engraved was equally covered with a finely powdered resin. The plate was then warmed, to attach the grains to the surface of the metal. A tracing of the design to be engraved was laid upon the resin, and the surface of the plate, after the whites had been stopped out, was submitted to the corroding action of acid, which, acting between the grains of resin, produced a granulation in the face of the metal plate. The light parts of the design were next stopped out, when the acid corrosion had been carried far enough. The darker parts of the design were again submitted to the action of acid, and this process was repeated till all the gradations from light to shadow, required by the design, were produced in the metal. A slight amount of burnishing and scraping of the plate so bitten in was then resorted to, to blend the several parts of the picture, and to heighten the lights where necessary. This process was carried to great perfection by Mr. Sandby about 1799. Such were the various processes in general use at the beginning of the present century, the whole being originally executed in copper. A growing demand for book illustrations, and a necessity for producing the engraving in a more durable metal, and one that would consequently yield a greater number of impressions, led to the introduction of the next process.

Steel and Machine Engraving.—The invention of steel engraving is due to Mr. Perkins, who first introduced the art in America; his object being to increase the facility, cheapen the cost, and produce absolute identity in the manufacture of bank notes. In order to effect this, he etched or engraved a steel plate, or, more properly, a block of soft steel, by the ordinary process of line engraving. The plate or block was then hardened. A cylinder of very soft steel, of from two to three inches in diameter, was then rolled backwards and forwards under pressure on the surface of the steel plate, until an impression from the engraving was obtained in relief on the face of the cylinder. The cylinder so obtained was in its turn case-hardened, and by rolling the hardened die over the surface of a flat plate of copper or soft steel, an exact copy of the original engraved plate, with all its sharpness, was secured. This process being repeated, any desired number of plates could be obtained from the die. As the object first sought was the production of bank notes, and the cost of elaborate designs was great, a machine was invented in America by Mr. Asa Spencer, which was called a geometric lathe, and this was employed in the production of geometrical figures in combination with line engravings, as borders and ornaments on the face and back of notes. Mr. Perkins brought his invention to this country, where it was introduced and known as the "sederographic" process for multiplying copies of engravings. Soon after his arrival in this country he was joined in working his process by Mr. Heath, and they state, in 1821, "we cannot yet say how long a well hardened steel plate will last, having never printed more than 500,000 impressions from the same plate. It should, however, be observed that this plate consisted principally of writing, or work quite as strong. It may also be observed that the impressions are yet good." The first steel plate engraved in this country is attributed to Mr. Raimbach, who was soon afterwards followed by the chairman of the Fine Arts Committee of the Society of Arts, Mr. Charles Warren. Engraving on steel, beyond necessitating a change in the nature of the acids used, and a better and more perfect graver, involved but little alteration in the process of engraving itself. Steel plates yielded a much larger number of impressions, but they also demanded more time in their execution, and, as a consequence, a higher rate of remuneration for their production; and thence arose a class of men whose works as artists gave fashion to the art of engraving and book illustration; and out of their labours came such works as "The Forget-me-not," "The Keepsake," "The Book of Beauties," &c., &c., coupled with which works are the names of the Findens, Charles Heath, Rolls, Lacy, the Le Keuxs, Goodall, Wilmore, Doo, and others, a school of engravers which has now entirely passed away. With the extended use of steel, however, came a proportionately heavy charge for printing, which, where large numbers were required, it was desirable to reduce as far as possible. This charge was not material as affecting high-priced works, but a considerable demand for illustrated books having arisen, a readier and cheaper means of illustration was required. We accordingly find that "Hone's Every-day Book" and "The Penny Magazine," which were popular works, and amongst the earliest examples of cheap literature, were illustrated with wood engravings, which, being produced in relief and capable of being printed with the type, saved the ordinary extra charge due to printing from steel plates. But, however artistic and effective wood blocks were, they lacked the refinement of the steel engraving. Concurrently with this spread of art in England, came the opening of the American, and the creation of an Australian market for English literature, and the adoption of a German discovery, which has done more to revolutionise art in this country than any other previously introduced, viz., the invention of lithography by Alois Senefelder, who, about 1795, while in search for a cheap means of printing the pieces which as a dramatist he produced, by an accident discovered that by writing on a slab of Kelheim stone, with ink prepared with wax, soap, and lamp black, and then biting in the stone with *aqua-fortis*, a surface in relief could be obtained, from which prints could be taken almost as easily as from wood blocks. This discovery led to the art of lithography as now practised. To the growth of the lithographic art I shall return hereafter, but for the present I would merely say that its introduction, and the great cost, as well as the time involved in printing from steel or copper plates, led to numerous attempts to cheapen the cost of engraved plates, and also to multiply the plates when produced. The process introduced by Mr. Perkins was inapplicable to large surfaces, both on account of cost, and the difficulty and risk of injury in applying it. But machinery had been applied in the form of the geometric lathe, and a desire was created to possess a machine of a simpler character which might be employed to produce skies and backgrounds in architectural subjects, as well as backgrounds to portraits, without involving the skilled, and in many cases monotonous labour of etching. This want was soon supplied by Mr. Lowry, who was speedily followed by Mr. Porter, Mr. Taylor, Mr. Storker, and others. By the first-named a machine was invented for ruling either straight or waved lines, which lines, when used separately, produced flat or graduated tints, and when used in combination produced the effect now so generally seen on the face of banker's cheques. Mr. Taylor's machine consisted of a square bed, upon which the plate to be ruled or engraved was laid, and over which a second bed was slidden or thrust. This bed was held in position by means of springs, which pressed against the inner side of a frame, over and attached to the upper and lower edges of the square bed of the machine. At the back or right-hand side of the machine was a solid block, to which was attached, on its centre, a female screw, in which worked a clamping screw. The motion of the machine was produced as follows:—A bar of iron, having at one end a pin fitted into a socket on the sliding bed, while its other end passed through a slot below the female screw plate on the back of the machine, and a clamping screw being brought down upon this bar, prevented the sliding bed being moved from its position until it was thrust forward by an index lever, placed at right angles to and connected with the iron bar. The degree of motion of the bed was then regulated by the distance through which the index lever was thrust, and this was determined by means of a screw-stop. Mr. Storker's machine had for its bed an inclined plane, over which worked a second wedge-shaped bed, and the tint was ruled by gradually removing the thick end of the wedge from the centre or edge of the machine. In both cases, after motion had been given, to regulate the width of the lines to be ruled, a carriage, carrying a diamond point, was caused to travel above the face of the plate to be ruled, and the diamond being allowed to drop on to it, the line was drawn or etched. By substituting for the straight line in which the carriage travelled any required character of etched line, and causing the carriage carrying the diamond point to travel in it, a corresponding motion was communicated to the diamond, and the desired effect was thus mechanically obtained. But where lines were required to be ruled in perspective, the plate was fixed on a bed which revolved on a centre. The use of these and other similar machines was soon largely resorted to, and ultimately line engraving, as a commercial production, deteriorated; and in its place grew up a mere vulgar effect of light and shadow, the combined result of a set of lines ruled over the entire surface of a steel plate, and then acted upon by acid, as in the case of aquatint engraving. There were, however, other forms of machine engraving introduced, which have given rise to new industries, and continue still in use, such as the medallion engravings executed by Mr. Bacon's machines, in which a medal or modelled design was employed, and over the medal a tracer was made to travel, which varied in its direction from a straight to a curved line, in proportion as the surface was either flat or in relief. The background of the medal was represented in the engraving by a flat tint, while the high lights of the medal were produced by a widening of the lines, and the shadows by a comparative contraction of them. Modified forms of this machine are still in use, and have been applied to engrave rollers for printing calico and other fabrics. The result of these machine processes, coupled with the introduction of lithography, was to create serious competitors with the aquatint and mezzotint processes, which may be said to have been swept away by the great advance which lithography has made, to the consideration of which we will now return.

LITHOGRAPHY.—I have stated that Senefelder discovered, about the year 1795, the principle upon which lithography is based, but it was not till 1819 that much progress was made in the art; but at that date, owing to the fostering care of Baron Aretin, in Munich; Count Lasteyrie in Paris, and Mr. Rudolph Ackerman in London, an account of the art of lithography, showing its then state, appeared. The establishment of the art of lithography in England is, however, due to Mr. Hullmandel, who not only drew upon stone with crayons and printed from them in black ink, but soon carried out the process by drawing on two or three stones, and printed from them with ink of a neutral tint; he also drew on several stones, and printed from them in colours. Mr. Hullmandel introduced the process known as lithotint, the drawing being made upon the stone with a brush and liquid ink, and he also applied the process of stump drawing. The facilities which drawing with the crayon, the stump, and the brush, afforded for the production readily, and at a moderate cost, of a surface from which to print, soon gained for the art a large amount of public support, and enlisted the sympathies of the late Mr. Mulready, Mr. J. D. Harding, Mr. Louis Haghe, Mr. James Ward, Mr. J. Lane, and other Royal Academicians and artists, who applied themselves to the production of sketches on stone. There was, however, in the early attempts at lithography, a crudeness of effect and a want of gradation from light to shadow. To overcome this, Mr. Hullmandel made a material between ink and chalk, which, being applied to the hard edges, carried the full tints by gradation into the high lights. The effect thus obtained advanced the art in the estimation of artists, as it increased the facility for producing artistic effects, which was also greatly helped by the use of tinted paper and printing in neutral tints from several stones. Printing in colours was practised by Senefelder, but his early specimens give but a faint idea of the richness and beauty of the productions of Mr. Owen Jones, who applied himself to develope the powers of lithography, and who not only drew upon stone, but also printed in gold and colours the whole of his work illustrative of the Palace of the Alhambra. In addition to drawing on stone and printing in flat colours, he introduced a method of printing from graduated tints drawn in ink only upon the stone, graduating his tints by stippling upon polished stones with a fine camel hair pencil.

Litho-tinto is a method of drawing, in which washes of ink are applied to the surface of the stone, but it is not largely in use, though many artists have employed the process in the reproduction of their own sketches. The process of stump drawing by Mr. Hullmandel afforded great facilities for the production of even and graduated tints over the stone, and soon became a process in general use. The cost and inconvenient weight of the lithographic stone led to a desire to find a substitute, and for a large amount of commercial work drawing on zinc has been found to answer, and is now extensively in use. This fact leads me now to refer to the commercial, rather than the artistic use of lithography.

I have said that the discovery of lithography gave a means of printing from the surface in a manner similar to the process of printing from type or wood blocks, but owing to the slight relief of the drawing on the stone, and the necessity for wiping with a wet sponge, and gumming the surface of the stone to prevent the absorption into the stone of the grease from the ink, the process is nevertheless a tedious one, but this evil is in a measure compensated for, by the facility which the lithographic process affords for multiplying copies of a drawing when once made, by transferring an impression taken from the drawing first made to a second portion of the stone, and as this can be repeated to any extent, a number of copies can be printed at one operation—the only limit being the size of the stone, and the nature and size of the design to be printed. The want of an efficient substitute for steel and copper plates, in the form of a surface block from which to print with the type in ordinary type printing presses, still remains a desideratum, notwithstanding all that lithography has done, and the many attempts which have been made. Casts in relief from engraved copper plates were among the earliest efforts in this direction, but the cost and labour of producing a uniform surface fit for the printing press, has not hitherto led to a commercial success.

ELECTROTYPE.—We now come to a period in the history of engraving at which another new discovery was given to the world, and one which has since played an important part in the arts. I refer to the discovery of the process of electrotyping. In the year 1800, Volta, in a communication to the Royal Society, announced his discovery of the Voltaic pile. By its means Nicholson effected the decomposition of water and of several metallic salts. Cruickshank next invented the galvanic battery, to the positive poles of which he attached silver wires, the other ends of the wires being placed in a glass tube containing a solution of acetate of lead. When the electric current had passed through the solution for some time, metallic lead was found deposited on the negative pole. Brugnatelli observed the transfer of the elements of a decomposed compound from one pole to another. In 1801 Wollaston made the following observation, viz.: — That if a piece of silver, in connection with a positive metal, be put into a solution of copper, the silver is coated over with the copper, which copper will stand the operation of burnishing. It was not, however, till after the discovery by Daniel of his constant battery, in which copper is continually reduced upon the negative plate, that it was observed that the newly-deposited copper, when stripped off, had upon it a counterpart of every scratch on the plate upon which it was deposited. In 1837, Mr. Spencer, of Liverpool, discovered that if a portion of the surface of the negative plate was covered with varnish, then no deposit took place upon those parts. He next conceived the idea of applying this process to the arts, by coating a piece of copper with varnish and wax, and cutting a design through it so as to leave the copper bare, and then depositing a metal upon these parts, so that on removing the varnish the design would be left in relief; but no account of these experiments was published till September, 1839. In May of that year it was announced in the *Athenæum* that Professor Jacobi, of St. Petersburgh, had discovered a method of converting any line, however fine, if engraved on copper, into a relief by a galvanic process. This announcement was followed by a letter from Mr. C. J. Jordan, which appeared in the *Mechanics' Magazine* in June of the same year; and it is due to Mr. Jordan to state that the suggestions he then made have since been acted upon with considerable success. Mr. Robert Murray next discovered that if the surfaces of plaster casts and similar non-conducting bodies were covered with plumbago or black-lead, it was no longer necessary to use metallic moulds, which had hitherto proved the great barrier to the progress of the electrotype art. Chemists and artists were not slow in their endeavours to apply this newly-discovered process as a means of multiplying copies of engraved plates, both of copper and steel. In the latter case, an impression was taken from the steel-plate, by covering it with a sheet of tin-foil, and passing it through the printing-press. The result was a print obtained in relief on metal. Upon this a deposit of copper was made of the required thickness, and the required plate from which to print was obtained. In the early experiments the plates were thin, and curled in printing; this defect was, however, soon overcome, and the practice of engraving in copper, where large plates were to be produced, as in the examples issued by the Art Union, was again soon reverted to, thus affording facilities which are now largely availed of, for multiplying copies of costly engravings at the same time that the quality of the works produced can be maintained against wear.

GLYPHOGRAPHY.—The next application of the electrotype art to which it is necessary to refer, was that patented by Mr. Edward Palmer, and introduced under the title of "glyphography, or engraved drawings for printing at the type press after the manner of woodcuts." The process was a compound of drawing and engraving on a plate of copper, the surface of which, having been stained black, was then covered with a thin layer of a white opaque composition. A tracing of the design to be drawn or engraved was made. Needles, of various degrees of breadth and form, were then employed to remove the composition from the surface of the copper, beginning with the greatest breadths of shadow, and gradually working up to the lighter and more delicate parts of the design. When finished an electro deposit was taken from the drawing so made, and a block in relief was thus obtained, which, being mounted in the same manner as an ordinary stereotype plate, was capable of being worked in with the type, and printed from, in the machine and steam printing press. It is necessary to state that the composition on the face of the plate was extremely thin, and in order to obtain the required relief for a printing block, recourse was had to a secondary process for increasing the amount of relief in the blocks, and this was done to any desired extent. The specimens which Mr. Palmer presented to the world, of work produced by this process, left little to be desired so far as artistic effect was concerned; but as the process has not become general, I fear the cost of producing the blocks was not commercially economic. Among the artists who first applied this process may be mentioned Thomas Landseer, J. Bateman, W. S. Wilkinson, Alfred Crowquill, J. Fraser Redgrave, and W. H. Pain. This process is not so generally known as its merits and capabilities entitle it to be, and the problem of how to obtain with facility a substitute for the wood block still remains unsolved. Among the numerous other plans proposed for use in the production of engraved plates or blocks, may be mentioned voltatype, electro-tint, daguerreotype, and etching by galvanism.

ETCHING BY GALVANISM was suggested by Mr. Alfred Smee; it was similar to the ordinary process of etching, but instead of being bitten in by a direct acid action, Mr. Smee suggested that the etched plate should form the positive pole of a battery, and being dipped in a galvanic trough of sulphate of copper through which a current was passed, particles of copper would be given off from the etched lines of the engraving; the plate was to be removed from the bath from time to time, for the purpose of stopping out, and graduating the tints required, as in the usual etching process. Mr. Smee considered that the advantages of his galvanic process are the absence of nitrous fumes, greater uniformity of action than when acid is used, greater rapidity of biting, and at the same time any required depth of line can be obtained and the lines themselves will be sharper and cleaner, owing to the etching ground not being torn up by air bubbles. I am not aware that the suggestion of Mr. Smee has ever been commercially applied, but he has continued his investigations. In 1851 he presented a report to the governor of the Bank of England, in which he stated that he considered the time had arrived when surface printing from electrotype blocks could be advantageously employed in the production of Bank of England notes. His proposition has since been carried out, and at the present time Bank of England notes and cheques are so printed. I would not have it inferred from this fact that what is economic and available for Bank of England purposes, is either expeditious or commercially available. Those who desire full details of the process employed by Mr. Smee in the production of surface blocks, I would refer to a paper read by him before the Society of Arts, on the 20th December, 1854, and which is published in full in Vol. III., page 81, of the *Society of Arts Journal*. Etching by galvanism forms the connecting link between electro engraving and the daguerreotype art.

ETCHED DAGUERREOTYPES.—The discoveries of Mons. Daguerre were first formally communicated to the world by M. Arago, who, on the 7th January, 1849, read an account of them before the Academy of Sciences in Paris. The invention consisted in the discovery of a process whereby the image obtained in the camera obscura could be permanently fixed on a metal plate. The process soon became known as the daguerreotype art, and its results as photogenic drawings. These were produced upon plates of copper coated with silver. The silvered surface was then washed with a solution of nitric acid, after which it was placed in a closed box, where it was subjected to the action of the fumes of iodine. An ioduret of silver was thus formed. Thus sensitised the plate was next exposed to the action of the rays of light within a camera, when the image to be copied became impressed upon it, and was then permanently fixed by immersing it in a bath of hyposulphate of soda. Having been well washed with clean water, it was capable of being exposed to ordinary daylight without injury. Mr. W. R. Grove, in 1841, described his method before the Electrical Society, and stated that he used dilute hydrochloric acid in the galvanic trough, having first coated the daguerreotype plate with gold, which amalgamated with the mercury on the surface of the plate, and that this acid, by acting unequally upon the different parts of the daguerreotype plate, according to the extent to which the light and the mercury had before acted, bit it away in the manner of an etching, so as to produce deep lines in the shadow parts and fainter ones in the light tints. The proposition of Mr. Grove was not lost sight of by Mr. Claudet, Mr. Fox Talbot, and others, who early made attempts to engrave and print from the daguerreotype plates, but the delicacy of the surface of the plate, and the nature of the subjects selected, prevented the process from being practically adopted. Subsequent discoveries, and the art of photography, to which I shall presently refer, have, nevertheless, produced some of the most perfect examples of engraving by the combined action of light and electricity.

I must now retrace my steps and recall attention to the discovery of Mr. Murray, who, having succeeded in giving a conducting surface to non-metallic bodies by the use of plumbago, placed within the reach of the scientific man a new and as yet unheard of process of engraving, which is now known as Nature Printing. The first examples of this art were also due to the discovery and use of a substance made known to the world through the Society of Arts in 1843—I mean gutta percha.

Nature-printing, as it is called, was first introduced to the notice of the public through the Society of Arts, which, in its notes of proceedings for the year 1849, printed a communication from Dr. Ferguson Branson, of Sheffield, in which he stated he had ascertained that by embedding a fern leaf, or any other flat body in softened gutta percha, and then allowing the gutta percha to cool, upon removing the leaf a perfect mould was obtained, from which mould an engraved copper-plate fit for the printer could be secured by means of the electrotype process. A plate so obtained, with prints taken from it, accompanied the communication. Nature-Printing, however, did not long remain in this normal condition, for in the Exhibition of 1851, in the Austrian department, were exhibited specimens of plants, flowers, &c., printed in colours from copper plates. It had been ascertained that if a rolling pressure was employed to embed the object to be copied, that then soft sheet lead could be used, and that process was subsequently introduced into this country, and employed by Mr. Henry Bradbury in the production of his work on Ferns and Mosses. Nature-printing did not stop here, for in a communication read before the Society of Arts in 1854, by Mr. Aitken, of Birmingham, we find that, by means of a rolling pressure, objects of various kinds, and of the most delicate description, such as thread-lace, the down of a feather, &c., could be made to engrave itself in Britannia metal, copper, brass, German silver, or tin plate, and, to use Mr. Aitken's words, "more wonderful still, on what we are led to believe is the most dense and hardest metal in ordinary use, viz., steel." Mr. Aitken pointed out some novel and interesting applications of nature-printing then in use at Mr. R. F. Sturge's works at Birmingham, in the ornamentation of metal surfaces, by means of patterns cut out of sheets of paper, and placed between two plates of soft metal, and passed through the rolling press. The effect produced was that of a burnished figure in relief upon a frosted ground; this resulted from the contact of the two metal surfaces, which burnished each other; but the paper, being embedded in the two metals, gave to the surface of the metal round the pattern a grain which may be described as a print from the pulp of which the paper was made. I must not, however, here enter upon the industrial and manufacturing uses to which electrotype deposits and nature-prints have been applied, but will direct attention to another process, in which the principle of nature-printing has been proposed to be applied as a substitute for engraving—I mean the process submitted to the Society by Mr. George Wallis, and called by him Auto-typography. In this process Mr. Wallis substitutes for, or in combination with, a natural object, a drawing made upon a surface of gelatine. This he selects as it has no grain, and is to a great extent non-absorbent. His drawing is made with an ink or fluid, which, when dry, either crystallises or forms a naturally-granulated body in relief upon the surface of the gelatine. The drawing, having been carefully prepared, is then passed through a press, in contact with a metal plate, into the surface of which the drawing becomes embedded, and the result is a transcript in copper of the artist's own drawing, from which prints may be worked in the usual manner. Notwithstanding the suggestions above related, I regret to say we are still without that great desideratum, a surface block, or a ready means of obtaining one, at a commercially economic rate by a process which will give to the artist a true translation of his sketch or finished drawing, to the commercial world an economic means of extending a knowledge of art, and of cheapening the cost as well as extending and facilitating the means of book illustrations, and to the public the advantage of a ready means of cultivating economically a knowledge and a love for all that is elevating and beautiful, both in nature and art, as well as a means of educating the youth of our country by means of cheaper, more numerous, and better examples than are at present generally attainable. But before I close this communication, which I propose to do by referring to other processes which I thing deserve more attention than they have hitherto received, and which I believe to be capable of helping to solve the problem of how to obtain a surface block, I must, in justice, refer to the photo-galvanographic process of Mr. Paul Pretsch, the photo-lithographic process of Colonel James and others, and the process for enlarging and reducing drawings and engravings patented by Mr. H. G. Collins. I have already spoken of the efforts which Mr. Grove made to engrave the image obtained upon the daguerreotype-plate, and it is due to Mr. Archer, who was the first to propose the use of collodion as a medium upon which light might be made to impress an image, that I should state that it is to that gentleman's discovery that the world owes its present advanced position in the art of photography.

Photo-galvanography.—Without the collodion film Mr. Paul Pretsch's photo-galvanographic process of engraving would not have existed, as light could not be transmitted through the daguerreotype plates, and the paper processes of Mr. Fox Talbot and others would have been inadmissible. Mr. Pretsch knowing that gelatine, if treated with bi-chromate of potass and submitted to the action of light, possessed a power of expansion, and availing himself of that fact, used a photographic image taken on collodion as a means of partially intercepting the rays of light, thereby regulating their action upon sensitised gelatine, and as a result he obtained a positive photographic image in relief in gelatine. The image, being allowed to dry, was then coated with black lead, and served as a mould in relief upon which to deposit, and from which he obtained by electro-deposition an engraved copper-plate of the original collodion photograph, from which plate-prints could be taken as in ordinary copper-plate printing; and it is right to add that some of the best specimens of prints from chemically-engraved plates ever seen were so obtained and introduced into commerce. But the fault which attached to the aquatint and mezzotint processes of engraving, also attached to Mr. Pretsch's process, viz., the surface or grain of the plate was too fine to yield a large number of good impressions, and that is no doubt one of the many causes which have impeded its extended use. The acierage process of M. Joubert for coating copper plates with an iron surface (described below), was not introduced at the time Mr. Pretsch was working his invention. Mr. Pretsch succeeded in producing surface blocks by his photo-galvanographic process. In order to obtain a surface block, it must be borne in mind that the process, as compared with the intaglio plate, is reversed. In the engraved plate the impression is printed from the lines cut into the plate, but in the case of all surface blocks, it is the portions which are not to be printed from which have to be removed by the graver. In like manner Mr. Pretsch used a negative photograph in one case and a positive in the other, thus reversing his results.

Acierage.—The acierage process is thus described by M. Joubert:—

"My invention has for its object certain means of preparing printing surfaces, whether for intaglio or surface printing, so as to give them the property of yielding a considerably greater number of impressions than they are capable of doing in their ordinary or natural state. And the invention consists in covering the printing surfaces, whether intaglio or relief, and whether of copper or other soft metal, with a very thin and uniform coating of iron, by means of electro-metallurgical processes.

"It having become a desideratum to harden, if possible, the surface of a copper plate, and to protect it from wear while printing, in March, 1848, my friend, M. Jacquin, of Paris, took out a patent in this country for a method of coating plates with iron, which had already been successfully applied in France, and of which the merit is due to my friend, M. Henri Garnier, of Paris.

"I have myself had the advantage of co-operating with M. Garnier in the development of the invention, the principles of which I shall now proceed to describe:—

"If the two wires of a galvanic battery be plunged separately into a solution of iron, having ammonia for its basis, the wire of the positive pole is immediately acted upon, while that of the negative pole receives a deposit of the metal of the solution—this is the principle of the process which we have named "acierage."

"The operation takes place in this way:—By placing at the positive pole a plate or sheet of iron, and immersing it in a proper iron solution, the metal will be dissolved under the action of the battery, and will form hydrochlorate of iron, which, being combined with the hydrochlorate of ammonia of the solution, will become a bichloride of ammonia and iron; if a copper plate be placed at the opposite pole and likewise immersed, the solution being properly saturated, a deposit of iron, bright and perfectly smooth, is thrown upon the copper plate, from this principle:—

"Water being composed of hydrogen and oxygen;

"Sal-ammonaic being composed of

"1st. Hydrochloric acid containing chlorine and hydrogen;

"2nd. Ammonia, containing hydrogen, nitrogen, and oxygen;

"The water is decomposed under the galvanic action, and the oxygen fixes itself on the iron plate, forming an oxide of iron; the hydrochloric acid of the solution acting upon this oxide forms a hydrochlorate of iron, whilst the hydrogen precipitates itself upon the plate of the negative pole, and, unable to combine with it, comes up to the surface of the solution in bubbles.

"I would remark that it is important that a ferric solution should be employed which will not dissolve or corrode the plate intended to be coated, for if it be attempted to use such a solution, though the iron will be precipitated, it will not only be in a non-coherent state, but the engraved surface itself will be liable to be attacked and injured. It may also be remarked that the coating of iron admits of being removed from a printing surface of copper without injury to the original plate, hence the original plate may, after being coated and used for some time, have the worn coating removed, and then be re-covered with an iron coating as often as may be required."

Photo-Lithography.—Colonel James, of the Hydrographic Department of the Government, has introduced and used a process of photo-lithography, to which I cannot do more than allude. It is similar, in many respects, to the photo-lithographic and zincographic process described by Mr. John Walter Osborne, in the *Photographic Society's Journal*, vol. 7, pages 163 and 213, as follows:—

"In the first instance, a sheet of paper is prepared with albumen, in the usual way known to photographers; it is, when quite dry, passed through a copper-plate or lithographic press, upon a polished steel or copper-plate, by which operation it receives a very smooth and regular surface; it is then coated on the same side with a solution of gelatine, to which an addition of bichromate of potash has been made; this is then carefully dried in the dark, and again passed through the press to ensure the finest surface. This operation completes the preparation of what I shall call the sensitive paper. Having made a negative of the original map bearing the desired proportions to it, I place a suitable piece of the sensitive paper just described under and in close contact with the map, and the whole is exposed to daylight in such a way that the luminous influence passing through the transparent parts of the negative, shall strike directly upon the prepared surface, while the greater part of the paper is protected from its influence by the dark parts of the negative, which correspond to the white places on the original map. In the presence of the organic matter, the actinic agency effects the decomposition of the bichromate of potash, and the liberated nascent oxygen in all probability reacts upon the gelatine, altering its chemical characteristics in a peculiar manner. The visible effect, after removing the negative, is the formation of a picture in brown, upon the clear yellow of the paper, corresponding to the transparent portions of the negative, or to the black lines on the original drawings.

"This positive photographic print is next covered with an even coating of lithographic transfer ink, by passing it through the press, face downwards, upon an inked-in lithographic stone; the pressure causes the whole of the sensitive surface to lay hold of the ink, and bear away with it an even coating, hiding the brown photographic positive from view. The altered parts of the gelatine which have been exposed to the luminous action, appear to be possessed of a certain amount of affinity for the grease of the ink, so that they will be found to retain it with considerable tenacity.

"The next operation is to coagulate the albumen which still exists under the prepared surface; this is done by floating it upon boiling water, with the paper side downwards. A subsequent soaking for a short time causes the unaltered gelatine to swell in such a way as to raise the ink with it from the paper; and a slight amount of friction, with a sponge or other soft substance, removes the supperfluous ink from all parts of the inked print which correspond to the white parts upon the original document. When the lines appear clear and well defined, boiling water is poured over the whole, to remove the last traces of gelatine, and the print is dried. We are now possessed of a *bonâ fide* lithographic transfer, that is, a drawing, in greasy ink, of such a nature that it admits of being transferred to the stone in the ordinary manner, by simply inverting it thereon, and passing it through the press,—the albumen, which will be found to have withstood all the washing, acting as the adhesive substance under the ink to prevent the paper slipping on the stone.

"The whole of these operations need not occupy more than from two to three hours."

Process for Enlarging and Diminishing Engravings.—Mr. Collins' process for enlarging and diminishing drawings or engravings was chiefly mechanical and lithographic. The plan was as follows:—A print from any engraved plate, wood block, or lithograph, was taken in the ordinary manner, but in transfer ink, and upon a sheet of vulcanised india rubber, covered with a composition of equal elasticity, and of a non-porous character. If it were desired to enlarge the design, the india rubber upon which the impression had been taken was attached to a frame by means of hooks passing through holes made at equal distances round the edges of the india rubber. Four bars were then passed through the body of the hooks, and the sheet was thus prepared for the extending machine, which consisted of two parts, viz., a table and screws, the latter being used to stretch the rubber equally to the required dimensions. The impression was then transferred and printed by the ordinary litho or zincographic processes. If the design was to be reduced, the india rubber was stretched before the impression was taken upon it, and afterwards allowed to contract to the required dimensions in the regulating machine. Mr. Collins considered that his process would afford a ready means of adapting a design, when once made, to the size and character of the same work when printed in editions of various size of page. Mr. Collins, however, found the lithographic process of printing a great impediment in the way of his progress, and attempted to obtain a surface block by building up the impression transferred to the stone, by depositing a succession of layers of printing ink mixed with suitable dryers, and when such building up of the ink had been carried sufficiently far, a cast in wax or other material was taken, and from the cast so obtained a copper block was secured by electro-deposition. This process was tedious and uncertain in its results, and like its predecessors, failed to secure the object aimed at.

I cannot help expressing an opinion that one great source of failure in the majority of the plans proposed has been, that the authors of them have been too ambitious in the selection of subjects, or almost entirely ignorant of the art of engraving. They have endeavoured to arrive at perfection at once, and have consequently failed. The subjects selected have in many cases been crowded in composition and too full of detail, and the result has been a deficiency of definition, a want of force, and an entire absence of artistic effect, due to the want of gradation in the lights and shadows. Several of the plans which have been proposed are probably capable of yielding good results, if the attempt to apply them is confined in the first instance to sketches in outline, a class of art but little practised, but one which is capable of affording the highest gratification and of employing the most skilled artists. By beginning with art in outline, experience in manipulation would be gradually acquired, and a chiaro-oscuro effect ultimately attained to if desired; and I have little doubt that blocks in outline can be readily produced, either by the electro-magnetic or mechanical process of Mr. Hansen, or the more recently-discovered processes of Messrs. Vial and Dulos.

Electro-Magnetic Engraving.—The process of Mr. George Hansen is as follows:—The drawing which it is desired to engrave is made on a metallic or conducting surface, with a resin ink, or some other non-conducting substance. As soon as the ink is dry or hardened, the plate with the drawing is placed on the moveable table or bed of a machine, side by side with a plate to be engraved. The machine is constructed somewhat on the principle of the planing-machine. A pointer or feeler is so connected by means of a horizontal bar with a graver, that when the bar is moved, the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. The plate is engraved by placing the graver under the control of two electro-magnets, acting alternately—the one to draw the graver from the plate, the other to press it down upon it. The drawing being made on a conducting surface, an electric current is established, so that when the feeler or tracer which passes over the plate, with the drawing upon it rests on the metallic surface, it passes through the coils of the magnet, and causes it to lift the graver from the plate, but when it reaches the non-conducting ink of the drawing, the current of electricity is broken, and the magnet ceases to act, and, by a self-acting mechanical arrangement, the current is at the same time directed through the coils of the magnet, which then acts powerfully, and presses the graver down into the plate. This operation is repeated again and again, till the entire surface has been cut away to a uniform depth by the graver, by passing it in parallel lines over the entire surface of the drawing. From the plate so engraved a type metal cast is taken, which being a reverse, in all respects, of the engraved plate, is at once fitted for use as a block for surface printing.

M. Vial's Instantaneous Engraving.—The process submitted by Mons. Vial to the Society has been so recently described (Vol. xii., p. 179), that I need do little more than refer to it, and my reason for doing so at all is for the purpose of pointing attention to the fact that Mons. Vial proposed to engrave plates by biting in the design, which was on that portion of the steel plate which was uncoated with copper. The question which I have to ask is, could not Mons. Vial reverse his process, by making the drawing to be engraved with a material which shall deposit the necessary protecting surface of copper on the steel, allowing the blank surface of the steel plate to remain open to the decomposing action of the sulphate of copper and nitric acid, thus giving as a result the drawing in relief on steel. Casts could then be taken, from which electro blocks could be readily obtained, and if the minutely granulated surface of a daguerreotype plate was capable of being coated with gold, and bitten in by hydrochloric acid sufficiently deep to admit of being printed from, I can see no reason if M. Vial takes an outline subject, and applies a similar process, why he should not readily produce a good surface block.

M. Dulos' Capillary Processes.—The last processes to which I have to allude are those recently submitted by M. Dulos to La Société d'Encouragement, Paris, and a full report of which will be found in vol. xi., of the Bulletin of that Society. The report is accompanied by prints illustrative of the results obtained by the methods which he employs, and as these have not hitherto been published in this country, they will doubtless be read with interest. M. Dulos' process is based on the phenomena of capillary attraction; thus, if lines be traced with varnish on a silver or copper plate with a silver surface, and mercury be poured over it, duly levelled, the mercury will attach itself only to the parts not covered with varnish, and will stand up and form a slightly convex wall on each side of the lines traced on the plate. A similar effect takes place if the experiment be made with a ground glass surface using water or some other liquid instead of mercury. Take, then, a copper-plate with a silvered surface, and transfer to it or draw upon it, by means of lithographic ink, any design whatever; then cover the plate by means of the galvanic battery with a thin film of iron, which, of course, will only be deposited on the parts untouched by the ink. The ink is cleared off by means of turpentine, and the plate then presents a surface of iron with the lines of the design in silver. Mercury is then poured on the surface, and it attaches itself only to those portions of the plate which are silvered. The excess of mercury having been removed with a soft brush, the metal remains in relief. From this a mould may be taken, and, by means of the electrotype, a copper-plate may be deposited, and this will be an exact copy of the original plate, having the lines in relief. This will serve as a matrix from which intaglio plates may be multiplied to produce impressions in the ordinary way. If plates for surface printing are required, a copper-plate receives the design, as before, in lithographic ink, varnish, or other material, and the plate is then, by means of the galvanic battery, coated with a thin film of silver, the film only attaching itself to the parts not drawn upon. The ink is then removed by means of benzine or turpentine, and we thus obtain a plate in which the design appears in copper on a silver plate. The plate is then bitten in by acid, which attacks only the copper lines, the rest of the plate being protected by the surface of silver. The rest of the process proceeds as before. Such are the principles and outlines of M. Dulos' process, which he has now brought to practical working by adopting various modifications and details. Thus he replaces the mercury by an alloy fusible at a low temperature, such as that known as the fusible metal of Arcet, to which he adds a small quantity of mercury. This alloy, when poured over the plate in a melted state, acts precisely as the mercury does, but becomes hard when cold, thus at once forming a plate from which an electrotype copy may be made. This operation, however, must not take place exposed to the air; the plate should be placed under a layer of oil heated to 80° (176° Fahr.), the temperature at which the alloy melts. Oxidation of the surface is thus prevented, which would otherwise injuriously affect the process. Special means are, however, required for removing the excess of either the mercury or the fusible metal, without which the finest lines cannot be retained. An amalgam of copper is found advantageous in the place of either mercury or fusible metal. On the plate, with the design on it, and treated as above, the amalgam is applied by means of a roller of silvered copper, which takes up all the amalgam lying free on the iron surface, and transfers it to the silvered portion. As soon as the amalgam sets an electrotype copy can be taken. M. Dulos suggests another modification, which depends on the property of silver to attach itself more easily to mercury than copper does, and the following is the mode proposed:—After having drawn the design on a copper plate with lithographic ink, the plate is silvered, and the ink washed away as before. If the plate be now plunged into a bath composed of a salt of mercury, say the sulphate, a chemical reaction takes place, by which the mercury becomes deposited on the silvered portion and the sulphuric acid attacks the coppered portion, or lines of the drawing. This operation, which lasts only a few minutes, forms lines in the copper, the sides of which are preserved by the transfer of the mercury from the copper to the silver. There is no more difficulty in drawing on the copper with the lithographic ink than on stone; and a drawing made in this way can be transformed into an intaglio, or surface plate, as may be required.

The following is a resumé of the processes used by M. Dulos.

Intaglio Plate.—The plate, drawn upon in the manner described, receives a coating of iron by means of the battery; the ink is then washed off, and it then receives, by means of the battery, a deposit of silver, which will only take place on the parts not covered with iron, *i.e.*, the parts drawn with the ink. A silvered copper roller, covered with amalgam of copper, is then applied to the surface of the plate. The amalgam attaches itself solely to those portions of the plate which are silvered, and leaves the iron uncovered. As soon as it solidifies an electrotype plate can be taken from it in copper which is ready for the press.

Surface-Printing.—The plate, and the design on it, as before, has a layer of silver deposited on it. The ink is then washed off, exposing the lines in copper, which then is oxydised by heating the plate. The silvered roller with the amalgam is then applied, and the amalgam attaches itself only to the silvered portion of the plate; and, on its becoming solidified, an electrotype copy is taken, which of course produces the lines of the drawing in relief, and a surface-printing block is thus produced, ready for the press.

Intaglio Plate.—This plate may be produced by using a salt of mercury instead of the amalgam. The plate with its design is silvered, and the ink is washed off as before; it is plunged into a bath of an ammoniacal sulphate of mercury, and whilst there the silvered roller is passed over its surface for four or five minutes. The mercury, by a chemical reaction, is precipitated on the silvered portion, and the plate is at once ready for printing from.

Surface-Printing.—A salt of mercury may also be used for this process; thus, the plate is drawn upon, coated with iron, washed and silvered as before, and is deprived of the iron by means of acidulated water. It is then plunged in the ammoniacal sulphate bath, and whilst there it is rolled for four or five minutes; the lines of the drawing are at once formed in relief. The plates thus formed may be at once placed in the printer's hands.

Aquatint.—The ordinary aquatint grain having been given to a copper-plate, a copper-plate in reverse is taken from it by the electrotype process. This plate is then silvered, and the drawing is made on it with the lithographic ink, the whites or high lights being produced by the scraper. A layer of iron is then deposited, and the ink washed away as before, and the roller with copper amalgam applied. From this an electrotype plate is made for printing, the hollows of which reproduce the original aquatint grain, the drawing, and high lights produced by the scraper. M. Dulos describes also another process, both for copper-plate and surface printing, in which he uses a white varnish (*vernis blanc*). The plate is covered with a varnish formed of caoutchouc and zinc white, which is readily cut through either with a quill pen or an ivory point, with which the design is traced on it. It is then plunged into the iron bath, and a thin film becomes deposited on the lines thus cut. If an intaglio plate be desired, the varnish is then washed off by means of a solvent, and the plate silvered, the silver only attaching to the copper surface, and not to the iron forming the design. The iron is then dissolved off the plate with diluted sulphuric acid, and the plate is treated with the mercurial salt as before. If a surface plate is desired, then the depositing the iron and silver is reversed. The copper amalgam may also be used if desired.

My object in writing this paper will have been attained if I have succeeded in showing the relation of the various art processes to each other. I have endeavoured to point out how each succeeding process has aimed at facilitating the means of reproducing and giving permanence to art, and a larger commercial product at a smaller cost to the producer and consequent advantage to the public. I have further endeavoured to show the methods which have been introduced, and the attempts which have been made to obtain more readily a true interpretation of the artist's conception, and nature's imprint of itself by means of a combination of lithography, photography, electricity, magnetism, and electrotypes, nature prints, and the amalgam of metals. Each process has been applied in the attempt to produce a surface-block from which to print. Hitherto, a commercial success has not been attained to, and my hope is that a knowledge of what has been done may cause others to carry on the investigation of this subject to a successful issue.

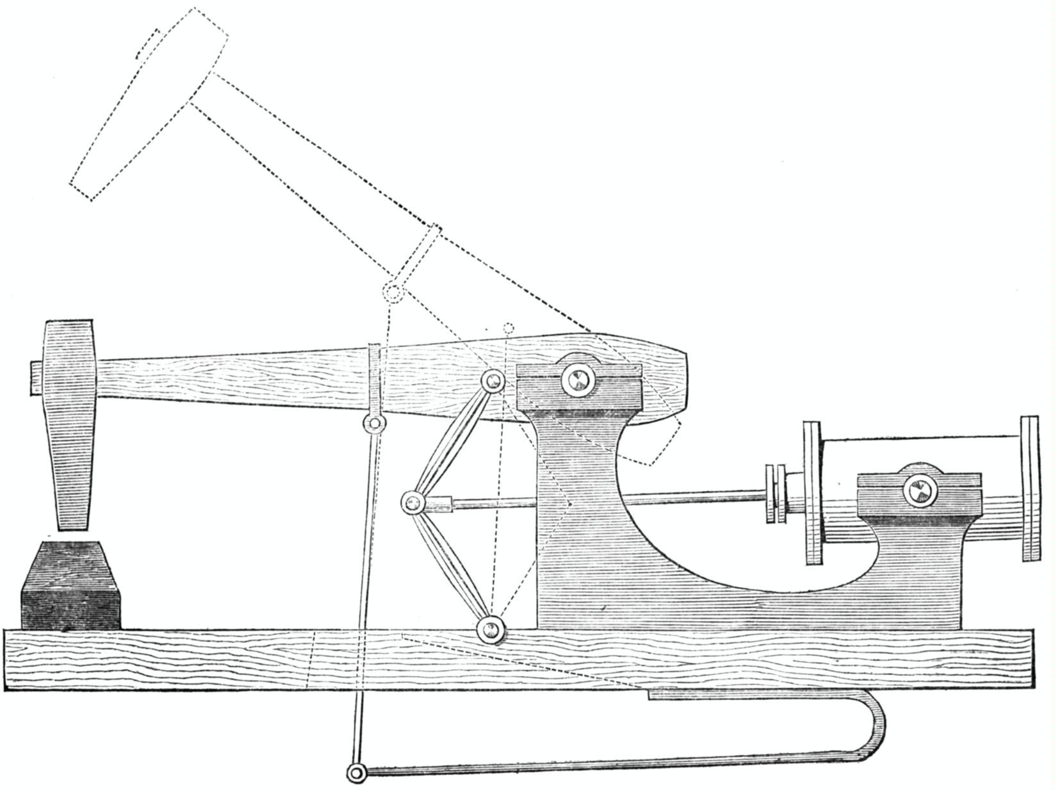
Fine Arts.

Public Monuments.—A grand memorial work is to be raised on the spot lately occupied by the Barrière de Clichy, to commemorate the brave defence made there under Marshal Moncey, in 1814, and the project has been submitted to public competition. Twenty-seven designs were sent in and six were chosen, the authors of which were invited to compete again amongst themselves. The prize has fallen to M. Doublemard. The principal group represents the Marshal protecting with his sword an allegorical figure of the City of Paris, and being supported by four other figures—a garde national, a man of the people, a polytechnic student, and a pensioner—these four classes having been conspicuous in the affair.—The subscription opened for the erection of a monument to the painter, Hippolyte Flandrin, in the church of St. Germain des Prés in Paris, has produced the sum of eleven thousand francs (£440), but as the work, designed by M. Baltard, is calculated not to cost so large a sum, it is proposed to apply the balance to the production of a repetition of the bust of Flandrin by Oudiné, to be placed in the Museum of Lyons, of which town the deceased artist was a native.—A colossal statue of Vercingétorix, the celebrated Gallic chieftain, is about to be raised in the town of Alise, the ancient Alesia, where that hero made a desperate resistance to Julius Cæsar. This statue is about twenty feet high, and the work of M. A. Millet, the author of a beautiful figure of Ariadne, of a fine bust of Madame Pauline Viardot, a memorial statue of the late Henri Murger, author of the "Vie de Boheme," and other well-known works. The model of the head, which was exhibited a short time since in the public gallery on the Boulevard des Italiens, promises well for the work. The difficulty and expense of executing such a gigantic work either in stone or bronze, have led to the adoption of an old and most artistic method, that of *repoussé* work, applied of late years almost exclusively to ornamentation, to architectural figures to be placed on churches and other high buildings, or to designs of a peculiarly simple form, such as angels with long flowing drapery, for organ fronts and other similar applications. In the case in question the difficulties will be considerable, for the model is characteristically picturesque in its treatment; the lines of the statue are broken and complex, with the details in sharp relief, the draperies flying, the hair floating in the breeze, and the hands grasping the hilt of a huge sword with all the savage energy of a hero at bay. A considerable portion of the work is done, and report speaks highly of the effect as far as it can be judged at present. The *repoussé* work has been entrusted to M. Aubert, an artist who has practised that method with great success. It will be remembered, by those who take a special interest in such matters, that a *repoussé* figure of about the same size of the one in question, the work of a German artist, was exhibited for some time beneath the porch of the central entrance of the Great Exhibition building in 1862. The Vercingétorix, when finished, will weigh about five tons, including the iron skeleton which is to support the thin colossus. It is to be mounted on a granite pedestal, of a size proportionate to itself, and the whole will stand on a small hill, so that the profile of the figure will be seen against the sky in every direction.

The Righetti Hercules.—The fine bronze statue of the youthful Hercules, found during the excavations beneath the Righetti Palace in Rome, about the destination of which so much has been said, has really become the property of the Papal Government. It is said that the Emperor of Russia offered to become the purchaser for a sum equal to £14,800, but that the fortunate possessor, Count Righetti, made it a present to the Pope, and that the Pontiff, not to be outdone in generosity, immediately ordered the sum of 2,500 crowns to be entered in the records of the Holy See as annuity to the Count and his family. His Holiness is also said to have presented the Count's son with a rouleau of gold, and it is added, moreover, that the donor of the statue is to be raised to the dignity of a marquis. Such is the account at present current of the transaction.

Manufactures.

Direct-acting Steam Tilt-Hammer.—At the ordinary meeting of the Society, on the 23rd of November, a model of a tilt-hammer, the invention of Mr. Henry Reveley, was shown. The following detailed description will be interesting to the members:—It will be seen, by inspection of the accompanying cut, that the principle of action is that of the broken lever, or knee-joint, and that the hammer is lifted, or thrown to its extreme height, at every half-stroke of the cylinder by means of the piston-rod, which is connected with, and forms part of the knuckle-joint. It will also be readily seen that the arrangement resembles, as closely as possible, the muscular power of the arm and shoulder of the hammerman, when he brings down the sledge with accelerating velocity upon the point of impact. The diagram is on a scale of one-third of an inch, reduced from the working model on a scale of one inch to the foot. The dotted lines show the knee joint in its three positions of front and back stroke, and at the point of greatest elevation, when the hammer is in a state of perfect repose, owing to the knee-joint being then perfectly straight. The driving, power must be a vibrating high pressure cylinder, with the usual jacket and slide valves, but no hand or starting gear will be required, only, as in all other steam hammers, the control of the steam way must be entirely in the hands



of the hammerman, or rather of his assistant, so as to be able to cause the hammer to strike a single gentle blow, or at the rate of three or four hundred per minute with extreme rapidity and power. The extent of the vibration of the cylinder is less than four degrees. In the diagram a spring is introduced, as in the original working model, in order to promote the return and fall of the hammer, but of course, on a large scale, the vacuum-piston would be the proper expedient.

Commerce.

WOOL. — Messrs. Ronald and Son, in their annual circular, state:—The imports of wool show a steady increase from year to year, those of 1864 being about thirty-one million pounds more than in the previous year, which increase consists chiefly of colonial wools. The exports, on the other hand, if compared with 1863, exhibit a falling off by about eight million pounds, owing to diminished shipments to America, caused by its almost prohibitory tariff; in fact, the decrease in exports to that quarter amounts to nine and a-half million pounds, but as opposed to this there is an increase in the exports to France, the total diminution is reduced to about eight million pounds. The quantity of wool left for home consumption is consequently very much more than in former years. From the Board of Trade returns we find that the exports of woollen manufactures have in the aggregate increased considerably, amounting for the eleven months ending 30th Nov., 1864, to £22,307,204, in place of £18,525,506 for the same period of the preceding year. Australian wools have this year arrived in larger quantity than ever, being 302,801 bales against 241,488 bales in 1863:—

IMPORTS AND EXPORTS OF COLONIAL, FOREIGN, AND BRITISH WOOL, FOR ELEVEN MONTHS:—

		COLONIAL. lbs.	FOREIGN. lbs.
Imports,	1860	86,460,239	42,202,888
,,	1861	96,095,597	33,464,621
,,	1862	99,278,974	48,560,126
,,	1863	107,226,923	47,270,926
,,	1864	128,730,453	57,184,135

		COLONIAL. lbs.	FOREIGN. lbs.	BRITISH. lbs.
Exports,	1860,	22,782,089	4,128,869	10,997,181
,,	1861,	38,087,570	6,580,625	14,501,006
,,	1862,	32,261,247	10,106,645	9,537,266
,,	1863,	43,163,742	12,179,788	7,956,463
,,	1864,	41,375,088	5,794,840	7,377,769

TEA SUPPLIES.—Messrs. Travers and Son, in their weekly Trade Circular, state that the Russian demand has been very much exaggerated, as during 1863 the shipments of tea to that empire only amounted to 1,280,788 lbs., but during the autumn of 1864, the readiest buyers of the new teas were the Russians, who were compelled to pay the high rates in order to get their purchases into the Baltic before winter began. With regard to the prospects of the tea trade during the present year, we may remark that the exports from China between June 1st and November 30th amount to 89,750,000 lbs., against 83,353,569 lbs., in the corresponding period last year; while the stock in the United Kingdom, in spite of a large and increasing home and export trade, continues as heavy as it was in the beginning of 1864. It seems probable, therefore, that the prices will decline still further. The reduction of the tea duty has already proved a great boon to the working classes, but it must not be supposed that they have yet reached one-fourth of their consuming power. While the middle and upper classes infuse 10 lbs. weight of tea per head throughout the year, the working man infuses less than three. When we consider that the slopes of the Himalayas alone are officially reported as capable of producing ten times as much tea as we at present import from all tea-growing countries put together and when we also bear in mind that Great Britain, Russia, and the United States are no longer the only tea-drinking countries out of Asia, but that all Continental Europe is gradually being weaned from the coffee-pot to the tea-pot, it may with confidence be asserted that the trade is in reality in its infancy,—that, large as our present consumption appears, it will be greatly increased in forthcoming years, while other nations who have as yet hardly begun to use tea will join in extending the demand, which can hardly exceed the supply.

Colonies.

THE CADIANGULLONG COPPER MINES.—Advices from the copper mines in New South Wales state that thirty tons of fine copper had been produced in October. The lodes continue of the same promising character, and the quantity of ore being raised is considerably on the increase. The fifth furnace has been completed, and a sixth is in course of erection. With these improved facilities, it is anticipated that there will be a large addition to the supply of copper monthly sent to market. It is also the intention of the directors to erect machinery for dressing the ore, which will further tend to increase the returns. The last parcel of copper sold by Messrs. Mort and Co., consisting of about ten tons, realised £92 5s. per ton.

SCHOOL OF ART FOR QUEENSLAND.—The sum available on public contribution of an equal amount is no less than £900. Upwards of £400 have been already subscribed; and, with the prospect of a substantial building, it can scarcely be doubted but that public confidence will be equal to a contribution of the remaining portion required to secure the whole of the parliamentary grant available.

COTTON AND ARROWROOT IN NEW SOUTH WALES.—Cotton and arrowroot have been grown by the Rev. Edward Holland, at Port Macquarie. Two bales of cotton, weighing altogether 319 lbs., were grown from Sea Island seed; it is considered by judges to be of very fair quality, being of a bright colour, rather strong in staple, and free from seed. Its value in Liverpool at the last quotations would be from 28d. to 30d. per lb. This is the largest quantity of cotton, the produce of the colony, that has yet arrived in the Sydney market. The arrowroot appears to be of very good quality, and to have been very carefully prepared. It was made by an experienced West Indian in Mr. Holland's employment. Mr. Holland states that he has about 400 lbs. of it, and that if a reasonable price were obtainable he could extend the production. It may possibly take some time to overcome the prejudice in favour of the imported article; but there seems no reason why the colonists should send to England for it if such good arrowroot can be made in the colony. At the recent show of the Agricultural Society a sample of sugar, also grown by Mr. Holland, at Port Macquarie, was exhibited, and attracted considerable notice; and the cultivation of sugar was strongly advocated by Mr. Holland, as one that would yield constant and healthy employment for thousands of old and young, while it would afford large profits to capitalists and cultivators who would take the matter up. Mr. Holland is entitled to much credit for the pains he has taken in testing the adaptability of this climate to the cultivation of the products of other countries, and also in communicating to the public the successful results of his experiments.

SILK IN THE CAPE COLONY.—The *Commercial Advertiser* states:—"A few days ago we paid a visit to the large collection of silkworms belonging to Mr. Wright, of the Royal Engineer Department, and were surprised to find that he had so large a number of worms, in all stages of their growth, some having but a few days previously emerged from their shell, while hundreds of others were forming cocoons of silk, and some had already finished spinning, the produce of the cocoons having been wound off ready for making up into skeins. It is no exaggeration to say that Mr. Wright has hundreds of thousands of worms under his care. Some idea may be formed of their number and voracity from the fact that they consume daily two sacks of mulberry leaves. This number of worms are the produce of half-a-dozen female moths some two years ago, and we can but regard the success of this experiment of producing silk on a scale large enough for purposes of trade as highly satisfactory. The mulberry that grows wild in this country is ascertained to be the real China variety, and it is therefore the natural food of the silkworm. It is well known, and can be easily cultivated, and forms an excellent hedge. The first course is a mere trifle, the attention required can be given by a child, while the silk will always command £1 per pound in the market."

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Southern Counties Association for the Encouragement of Agriculture, Arts, Science, Manufactures, and Commerce.—An Association under this head is now being formed, the objects of which are to promote by meetings in the counties of Hants, Berks, Oxford, Surrey, Sussex, and Kent[*] in succession,—1st, for the exhibition of stock and implements, or articles connected with the pursuits of any of the departments established by the Association; and 2ndly, for the reading of papers and discussions on subjects embraced within the scheme of the Association. The Association will be under the management of a council empowered to make bye-laws, offer prizes, nominate local or sub-committees, fix meetings, and do anything necessary to the carrying out of the objects of the Association; and the Council is to consist of a president, two vice-presidents for each county, an honorary secretary for each department, and 36 members, of whom an equal portion shall be chosen from each county by the members belonging to that county, or in default thereof, by the members in general at the annual meeting. An annual meeting and exhibition will be held in the months of May or June. Portions of the mornings or evenings of each day shall be given to the reading of papers and discussion. Each separate branch of the exhibition will be arranged and managed, under the control of the Council, by a sub committee of the department to which it belongs. Other meetings may be fixed by the Council for the reading of papers and holding discussions. A department for each subject embraced by the Association is to be established, and the societies promoting these objects, for the purposes of the exhibition and meeting, will be amalgamated. Agriculture in all its branches, with its implements and machinery, will form the first department; natural history, local geology, botany, and horticulture, the second; the arts, manufactures, and commerce, as developed in these six counties, the third; local history and archæology, the fourth; and the improvement of the dwellings and the general condition of the labouring classes, the fifth. Any other department may be added by the Council. Every subscriber of 10s. per annum shall be a member, and entitled to vote for the election of the Council. Every subscriber of £1 shall, in addition, be entitled to receive the reports and papers of the Association. Every subscriber of £2 per annum shall, in addition, be eligible for the office of president and vice-president. No subject or question of a political tendency shall be introduced at any meeting of the Association. Communications may be addressed to the Hon. and Rev. Samuel Best, Abbott's Ann, Andover; or Thomas Pain, Esq., Ugford-cottage, Salisbury. The first general meeting of the members, for the election of the officers and Council, and other general business, will be held at Guildford, Tuesday, January 17th, at one o'clock. A large number of noblemen and gentlemen of influence, and residents in the several counties, have signified their adhesion to the Association.

Michigan Lake Tunnel at Chicago.—The most important event connected with the Water Works, and making a part of their history for the year, is the commencement of work on the tunnel, to be extended out under the bed of Lake Michigan two miles, so that the water will be drawn from the lake that distance from the shore. This project was fully set forth in the last report of the Board, and was adopted early last year, as that promising to secure most certainly, and with least expense to the city, its supply of water from a point in the lake where it will not be affected by the discharge from the river, or other impurities from the lake shore. During the summer, examinations were made along the whole line of the contemplated work, by boring at short intervals, to the depth proposed for the tunnel, to ascertain the character of the material through which it would pass, and various observations were made to test the quality of the water at the proposed outer end and inlet for the tunnel, and to ascertain also the distance from the shore to which the water of the river reached after certain most marked discharges of the river into the lake. From the borings it was found that the material through which the tunnel would be built was uniformly clay, and apparently of a firm and even character; and the observations concerning the effect of the river on the lake showed that, even when most marked, no trace of its influenee could be detected much more than a mile and a quarter from the shore. The information obtained on these and various other points, satisfied the Board that the tunnel would accomplish the result sought for, and that the work was entirely practicable. The necessary drawings and specifications were prepared as speedily as practicable, and advertisements were issued in New York and Boston, as well as here, inviting proposals for the doing of the work. The bids were received and opened September 9th, 1863, most of the parties submitting proposals being present at the opening. The bid of Messrs. Dull and Gowen, of Harrisburg, Pa., being unconditional, and for the whole work, was accepted by the Board the day after the reception of the proposals, as the lowest and best bid. Soon after its acceptance, the Board made report of their doings to the Common Council, and requested to be authorised to proceed with the work, and to issue bonds to provide for its cost. The Council granted this desired authority by ordinance of October 5th, 1863. Subsequently to the execution of the contract, the Board desired to change the manner of constructing the land shaft, which was originally designed to be wholly of brick, and is so described in the specifications. The change consisted in substituting three cast iron cylinders, each ten feet long, essentially like the iron cylinders proposed for the outer lake shaft, in the place of the brickwork of the upper thirty feet of the shaft. This was done to facilitate the sinking of the shaft through the bed of quicksands overlying the clay, the distance through the quicksands to the clay being about twenty-four feet. The formal breaking of grouud took place on March 17th last, and the work has been in progress since that time, with occasional interruptions. As was anticipated, a good deal of difficulty has been experienced by the contractors in working through the water and quicksands, but the difficulty has been much less with the iron cylinders than it would have been with brick work, and the clay having been reached, it may reasonably be hoped that there will not be serious trouble from this cause hereafter. Of course the work is not sufficiently advanced to enable the Board to form a conclusion as to what rate of progress may be looked for. The time fixed in the contract for the completion of the work is November 1st, 1865. Besides the change in the manner of constructing the land shaft, the Board have agreed with Messrs. Dull and Gowen to make certain changes in the outer crib, so that the crib will be stronger than as originally proposed, and so that solid masonry can be eventually substituted for the mass of loose stones with which the crib will be filled. The State Legislature had previously given the necessary authority for placing in Lake Michigan any piers to be found necessary for constructing and maintaining the tunnel, but, to avoid any question as to the right of the State to make such a grant, the sanction of the United States to the act of the State Legislature was obtained by act of Congress, passed January 16th, 1864. The tunnel is to commence at such point as may be selected by the Board of Public Works, on the lot now occupied by the pumping works of the city of Chicago, at the east end of Chicago-avenue, and on the shore of Lake Michigan; and to extend two miles out under the lake, in a straight line, at right angles to the general direction of the shore. The bottom of the inside surface of the east end of the tunnel will be sixty-six feet below the ordinary level of the lake, or sixty-four feet below what is usually known as "City Datum;" and the bottom surface will descend uniformly, at the rate of two feet per mile, to the west end of the tunnel. There are to be one land and two to four lake shafts; the land shaft at the west end, one lake shaft at the east end, and the remaining lake shaft or shafts at such intermediate points as shall be determined upon by the said Board, when the proper time for locating them shall arrive. The lake shafts are to consist of cast iron cylinders, and to be protected by hollow, pentagonal cribs. The tunnel is to be very nearly circular in form, and to have an interior width of five feet, and height of five feet and two inches.—*From Report of Chicago Board of Public Works.*

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[*] **At a meeting held at Basingstoke, December, 12th, 1864, Viscount Eversley in the chair, the County of Wilts was removed from the scheme as being included in the Bath and West of England Society.**

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Lecture III.
Asiatic, 3.
R. United Service Inst., 8½. 1. Captain Jasper H. Selwyn, R.N., "Mineral Oils as a Fuel for Steam Ships." 2. Mr. C. J. Richardson, "Petroleum as Steam Fuel."
Tues. ...Civil Engineers, 8. Continued Discussion upon Mr. Taylor's Paper "On the River Tees." And, time permitting, Mr. T. Hawthorn, "Description of the Port and Docks of Marseilles."
Statistical, 8.
Pathological, 8.
Anthropological, 8.
Royal Inst., 3. Prof. Tyndall, "On Electricity."
Wed. ...Society of Arts, 8. Mr. Peter W. Barlow, F.R.S., "On the Best Mode of Applying Power to Propel Trains, on the Metropolitan and other Railways having Frequent Stations, and in Terminal Stations."
Meteorological, 7.
London Inst., 7.
R. Society of Literature, 4½.
Thurs. ...Royal, 8½.
Antiquaries, 8.
Zoological, 4.
Royal Inst., 3. Prof. Tyndall, "On Electricity."
Linnæan, 8. 1. Mr. A. Hancock, "On the Anatomy of *Doridopsis*." 2. Dr. Kirk, "On a New Banana from Tropical Africa." 3. Mr. W. H. Brewer, "On the Forests of *Sequoia (Wellingtonia) gigantea*, in California."
Chemical, 8.
Numismatic, 7.
R. Society Club, 6.
Fri. ......Philological, 8.
Royal Inst., 8. Prof. Tyndall, "On Combustion by Invisible Rays."
Sat. ......Royal Inst., 3. Prof. Marshall, "On the Nervous System in Man and Animals."

Patents.

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From Commissioners of Patents Journal, January 6th.

Grants of Provisional Protection.

Armour for protecting ships of war, &c.—3142—W. Tate.
Bedstead, portable—3124—A. H. Robinson.
Boiler tubes, stopping leaks in—3205—A. V. Newton.
Bonnet and cap fronts, &c., manufacture of—3168—C. G. Hill.
Books, &c., fastenings for—3158—G. Leach.
Bottles, apparatus for stopping—2966—J. H. Johnson.
Brushes—3209—J. H. Cheatle.
Carriages. lamps for—3138—W. Howes and W. Burley.
Chromates and bichromates—3203—B. Margulies and J. K. Leather.
Coal dust, method of aggregating—3170—F. Tolhausen.
Coating metals—3207—E. Morewood.
Coke ovens—3195—R. A. Brooman.
Cotton seeds, separating the kernel from the shell of—3118—R. A. Brooman.
Eggs, apparatus for boiling—2164—C. W. Standish.
Elastic fabrics, manufacture of—3136—H. L. Hall.
Engines—3112—S. Pettit.
Fencing and other staples—3187—T. P. Hawkins.
Fibrous materials, washing and drying—3122—W. McNaught.
Fire-arms, breech-loading—3144—E. Swinarski.
Flax, seeding and breaking—2082—G. Parsons.
Furnaces—3148—R. A. Brooman.
Gins, cotton—3199—W. H. Maitland.
Hasp locks—2954—A. V. Newton.
Inkstand, pen, and pencil holder, combined portable—3193—J. F. Wheeler.
Iron bridges—3166—J. Westwood, jun.
Jib sails, reefing and stowing—3150—J. Butchart, H. Stroud, and S. A. Morrison.
Land, application of steam to the cultivation of—3223—A. P. Blanchet.
Liquid meter—3134—R. A. Brooman.
Looms—3126—J. L. Norton and W. Ainsworth.
Looms—3176—J. Hargreaves.
Looms—3189—E. Taconet.
Looms, picker band used in—3162—W. Maynes.
Metal, cutting pipes and bars of—3213—J. Wolstenholme.
Metal plates, machinery for curving—3217—G. Alton.
Motive power, obtaining—2160—M. Barland.
Mules, self-acting—3130—B. Dobson, W. Slater, and R. Halliwell.
Night soil, collection and treatment of—2788—J. A. Manning.
Oils, obtaining purified or refined—3108—J. A. Pols.
Ordnance, apparatus for working and loading—3103—C. P. Coles.
Panoramic apparatus—3119—F. A. Chevallier.
Pottery, cylinders used in the manufacture of—3120—G. Brown.
Railway carriages, signalling or communicating apparatus for—3201—C. R. Bamber.
Railway trains, communicating and signalling on—3074—T. Wood.
Railway trains, communication by signals between different parts of—3172—J. W. Cowles and W. Warren.
Railway trains, signalling between passengers and guards—3156—S. E. Pettee.
Retorts, crucibles, &c., manufacture of—3185—J. Gillespie.
Sewage matters, treatment of—3160—H. Bird.
Sheets, surfaces, &c., flexible elastic waterproof—3110—C. Hancock and S. W. Silver.
Small metallic articles, apparatus for rolling, &c.—3219—J. Dodge.
Steam engines—3114—W. E. Gedge.
Steam engines, slide valves of—3152—H. J. H. King, H. E. Smith, and J. B. Howell.
Taps or cocks—3146—Sir J. Gray.
Varnish for protecting metals—3164—H. A. de Briou, jun.
Vessels, &c., affixing armour plates to—3197—E. Saunders.
Washing and scrubbing compound—3050—A. Surfleu.

From Commissioners of Patents Journal, January 11th.

Patents Sealed.

1715. T. McGrah.
1718. A. V. Newton.
1723. F. L. H. Danchell.
1724. J. Robinson.
1725. Z. B. Smith & J. Richards.
1726. B. Greenwood & I. Underwood.
1731. St. J. V. Day.
1732. J. Forbes.
1733. J. Tomlinson and T. Brassington.
1737. G. O. Wray.
1739. J. Francis.
1750. J. Gilmour.
1758. J. Bernays.
1759. A. A. Croll.
1764. F. W. Turner.
1765. W. C. Thurgar.
1766. R. A. Brooman.
1767. J. Clark.
1768. J. G. Tongue.
1770. J. Saunders.
1771. D. B. Grove.
1776. J. Gill.
1778. J. Chalmers.
1780. I. Swindells.
1782. T. Johnson.
1784. A. A. Bonnet.
1789. A. Barclay.
1790. S. Whitehurst.
1791. W. Whitley.
1798. F. C. Cosserat.
1799. A. Espirat and E. Sause.
1800. E. Lea.
1833. D. Hall and A. L. Roosen.
1857. H. A. Bonneville.
2167. W. Langham.
2174. F. Weaver.

Patents on which the Stamp Duty of £50 has been Paid.

55. J. Stenhouse.
56. H. Bessemer.
59. C. W. Siemens.
60. J. Smith and S. Wellstood.
63. D. Wilson.
65. D. Wilson.
80. W. Clark.
81. T. Ramsay.
140. W. S. Mappin.
250. W. Clark.
46. J. Tatham.
67. R. A. Brooman.
77. W. H. Preece.
138. W. L. Winans.
240. W. E. Newton.

Patents on which the Stamp Duty of £100 has been paid.

3178. T. Spencer.
3185. F. O. Ward.
16. J. Leeming.